DOCUMENT RESUME

ED 247 893 IR 011 242

AUTHOR Bacsich, P. D.
TITLE Viewdata-Style Delivery Mechanisms for CAL. CAL Research Group Technical Report No. 11.
INSTITUTION Open Univ., Walton, Bletchley, Bucks (England).
PUB DATE 81
NOTE 31p.
AVAILABLE FROM Institute of Educational Technology, The Open University, Walton Hall, Milton Keynes, MK7 6AA, England.
PUB TYPE Information Analyses (070) -- Reports - Descriptive (141)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Computer Assisted Instruction; Computer Graphics; *Computer Software; Design Requirements; *Distance Education; Evaluation Methods; Foreign Countries; Higher Education; *Input Output Devices; Systems Development; *Videotex
IDENTIFIERS *Optel; Prestel

ABSTRACT

The development and evaluation of a potential viewdata-style delivery system for computer assisted learning (CAL) at the Open University are described. First examined are Open University problems with CAL and television delivery systems, which resulted in the consideration of a viewdata approach involving allocation of a small central processor to each user to allow home terminal access to university programs. The Prestel system and its terminal are discussed in terms of their use in CAL. Characteristics and uses of Cyclops, a terminal developed at the Open University, are then outlined, including (1) capabilities for replaying cassette tapes containing picture and sound, and (2) use with light pens to provide an electronic blackboard for terminal-to-terminal communication. Preliminary and planned evaluations of the Cyclops system are summarized. An in-house viewdata system, Optel, which runs on a time-sharing DEC-20 mainframe computer, is then described, and results of a 1980 pilot trial are summarized. Current work which involves evaluation of the Cyclops terminal and Cyclops studio (a microcomputer system which allows a user to create color or black and white pictures in computer-readable form) is also discussed. Four references are listed. (LMM)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED247893

THE OPEN UNIVERSITY

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.
Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

Computer Assisted Learning Research Group

Viewdata-style delivery mechanisms for CAL

P. D. Bacsich

CAL Research Group Technical Report No. 11

IR011242

Walton Hall,
Milton Keynes,
England MK7 6AA

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
E.S. Henderson
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

COMPUTER-ASSISTED LEARNING RESEARCH GROUP

THE OPEN UNIVERSITY

List of Technical Reports

These reports may be obtained (free of charge but subject to availability) from:-

Ann Jones,
Institute of Educational Technology,
The Open University,
Walton Hall,
MILTON KEYNES. MK 7 6AA
England.

Report no.	Title and Author
1	M.A. Bramer (1980) Using Computers in Distance Education: The first ten years of the British Open University.
2	P.G. Butcher (1979) Computer Assisted Learning in Chemistry at the Open University.
3	M.A. Bramer (1980) COMAL-80 - Adding Structure to BASIC.
4	A. Jones (1980) An evaluation of the SOLO programming language: A pilot study of its use at summer school.
5	A. Jones, T. O'Shea (1981) An evaluation of tutorial CAL at the Open University: the use of Cicero in SDT286.
6	E.L. Whitelegg (1981) An evaluation of tutorial CAL at the Open University: the use of MERLIN in ST291.
7	M.W. Lewis (1980) Improving SOLO's User-Interface: An Empirical study of user behaviour and a proposal for cost-effective enhancements to SOLO.
8	A.T. Vincent (1980) Some applications of a microcomputer.
9	T. O'Shea, A. Floyd (1981) Recording Children's mathematical behaviour.
10	A.T. Vincent (1981) Computer-assisted support for blind students: the use of a microcomputer-linked voice synthesizer.
11	P. Bacsich (1981) Viewdata-style delivery mechanisms for CAL.
12	P.J. Murphy (1981) Biological simulations in distance learning.
13	P.J. Murphy (1981) Computer simulation in Education: Genetics and Evolution.
14	I. Every (1981) Graphics and animation in teaching dialogues.
15	P.J. Murphy, E. Scanlon, E.L. Whitelegg (1981) An evaluation of simulation CAL in the Science Faculty during 1980.
16	M. Eisenstadt, J. Laubsch, J.H. Kahney (1981) Creating pleasant programming environments for cognitive science students.

Viewdata-style delivery mechanisms for CAL

Paul D. Bacsich (Open University)

1. The Open University dilemma

The Open University is the largest university in the country, supporting some 65000 undergraduates. After coming into existence in late 1969, it very quickly took up a settled pattern of teaching methods: the bulk of teaching was carried by specially written text books, with a leavening of television and radio programmes. This original 'distance learning' stance was modified to allow limited face to face contact at a network of some 255 study centres, and week-long summer schools for the more 'practical' courses.

And this, some ten years later, is very much still the pattern. With one exception: the Student Computing Service, set up in 1970 to provide practical computing facilities for Mathematics students, has now expanded into a service supporting terminal access from the majority of study centres by students from about half the courses. A substantial part of that use is in the Computer-Assisted Learning area.

Much progress has been made. But CAL has still to 'break through' into the high ground of general acceptance. We have known for some years that a necessary condition for doing this is to bring terminal access to the student: to lend him (or encourage him to buy) a 'home terminal'.

While CAL has been slowly increasing in use, disenchantment with other media has grown. Tutorials are a labour-intensive use of staff. Study centres may be tens of miles distant from the student - not surprisingly student attendance can be low. Radio, always the cinderella sister of television in the Open University, has in many courses not been popular with students and its effectiveness dubious. Several courses have replaced live radio programmes with pre-recorded cassettes, often with associated workbooks. These have been quite successful, but the medium is difficult to use well.

Television has remained popular with students (and academic staff who appear in the programmes). However, a cloud has been looming on the horizon. As the number of courses increase the number of programmes without repeats,

or transmitted at inconvenient hours, also increases. The amount and 'quality' of BBC2 transmission hours is under downward pressure, especially with ITV2 in the offing.

So can one provide video material to students in some non-broadcast way? If video cassettes (or discs) are too expensive to produce and distribute, is there some lower-cost way of providing limited video material? These questions were very much at the centre of the 'Alternatives to Broadcasting' movement which flourished in the Open University around 1977.

The home terminal could have a role to play here. But we have a problem of access. The Computing Service has some 200 ports available in total on its three computers - a small number when one considers the few thousand students who might be expected to log in of an evening. If the number of ports was considerably expanded, the computers could not deliver the central processor power required for typical student packages. Hence large number of potential users implies, singly or severally:

(i) small central processor allocation to each, or

(ii) short times of phone connection, or

(iii) non-phone means of communication.

To make (ii) or (iii) work, we have to put intelligence in the home terminal. Essentially they are 'telesoftware' approaches. Scheme (i) is a viewdata approach.

Non-phone means of connection implies distribution by cassette (floppy disc being ruled out on cost grounds) or broadcast data transmission (by radio, or by TV as in Ceefax). The broadcast aspects have not yet been extensively worked on in the Open University, but may well offer a realistic solution in some cases, such as computing courses.

The Open University has a long tradition of providing home experimental kits for its students. In particular, students on the course TM221, 'The Digital Computer', which first appeared in 1975, were provided with a small microprocessor kit. This inspired various groups to look into a kit solution for a home terminal. But the work was in the end unsuccessful, one reason being that the lack of a mass market kept component and assembly costs high. So where to look for the mass market? In a nutshell, it is coming- and it is based round Prestel.

2. Prestel to Cyclops

Although its growth is as yet well below the Post Office's expectations, the Prestel system is likely to set the standard for mass market educational computing. Not that one cannot deviate from the standard, but one should do so with care and foresight.

Let us look first at the Prestel terminal. This is a specialised visual display unit, with a screen format of 24 lines of 40 characters (half as many characters as are usual). The character set is a version of standard ASCII. Each character can be displayed in one of seven colours (the three primaries, three secondaries and white) on a background in one of eight colours (the previous ones plus black). Characters can also be double height (useful for headings) or flashing (useful for error messages).

But as well as the ordinary alphanumeric characters, the terminal can display 'mosaic graphics' characters. In this mode the character rectangle is divided into 6 identical small rectangles: so that there are 64 possible patterns depending on which

rectangles are lit up. The net effect of mosaic graphics is to provide a graphics display with a resolution of 72 vertical by 80 horizontal.

For much domestic and business use, the Prestel display format is adequate, at the cost of a slightly rectangular style of graphic design. However, there are severe limitations when one comes to consider educational use, especially in the science/technology area. To begin with, the character set is inadequate: there are few mathematical symbols, and no Greek characters. Ideally, a second 96-character set needs to be available, giving a total repertoire of 192 characters. Secondly, the graphic resolution is inadequate: mathematical curves, diagrams and maps all suffer serious degradation when 'translated' into Prestel. A third, and more subtle point is that even the resolution of 72 by 80 is further degraded by the 'serial' method of encoding colour, as a glance at Prestel weather maps will establish.

After considerable study of the alternative, our group has designed a terminal called 'Cyclops' with the following characteristics. It is an 8-colour

graphics terminal with a graphic resolution of 240 points vertically by 320 points horizontally. The ratio 320:240 is precisely 4:3, which is the aspect ratio of a standard TV screen, and this implies that the individual pixels are square, a considerable simplification when it comes to constructing pictures. (It is worth noting that the graphic screen of the Terak microcomputer is also 240 by 320.)

The character repertoire available on Cyclops is one of 256 characters, divided into two fonts (G0 and G2) of 96 characters and a G3 font of 64. (The G nomenature stems from ISO and CCITT standards bodies.) The G0 font is the standard Prestel version of ASCII. The G2 font does not consist of a scientific/Greek character set, but, (unfortunately?) following CCITT standards, of variant latin letters, diacritics and some scientific signs. The Greek alphabet (upper and lower case) and other scientific signs are found in G3.

Additional characters can be drawn using the graphics capabilities, and there is provision for future versions of the terminal to allow software definable characters. The Cyclops character format

is 12 by 8 pixels, giving 20 rows of 40 characters. This allows realistic representation of accented capital letters, integral signs, and so on. A Prestel-standard 24-line format is also available.

On the graphics side, the terminal obeys commands to plot points, lines, polygons and blocks, and there is also a facsimile-type plotting mode.

However, it is the peripherals which transform this terminal into such a versatile tool. Apart from a keyboard, and a V24 serial computer interface, the terminal boasts a cassette interface and, most importantly, a light pen. When the pen is placed on the screen, the co-ordinates of its point are detected and supplied to the terminal. These are then turned into appropriate point or line plotting commands and transmitted down the V24 interface in full or half duplex mode. The net effect is that if two such terminals are linked, either user can draw on his screen and his drawing appears almost simultaneously on the other.

The cassette interface is normally connected to a standard stero cassette player. This allows the system to play prerecorded tapes one track of which carries ordinary audio information while the other carries audio-encoded ASCII characters. When such a tape is played the viewer sees what is essentially a colour television programme in which the picture consists of animated diagrams. The terminal contains an internal buffer so that a complicated picture can be built up off screen and displayed quickly when the sound track requires it. With this method and a fairly high data rate (1200 bits/sec) quite complicated graphical effects are possible.

3. Use of Cyclops

The main uses for Cyclops are seen as:

(i) replay of cassette tapes containing picture and sound

(ii) use of light pens to provide an 'electronic blackboard' for terminal to terminal communication

(iii) a general colour graphics terminal

(iv) a retrieval terminal for viewdata systems

The current version of Cyclops has only recently become available in reasonable quantity to the Open University so that systematic trials are only just under way. However, an earlier version of Cyclops (described in [4]) has undergone some limited user trials. In 1978 and 1979 a number of short teaching programmes were made for the Mathematics Foundation course, M101, and tried out at the summer school. Topics were chosen with which students were known to have some difficulty, for example, the Chain Rule in differentiation. Despite the fact that at the time our techniques for producing graphic material were very limited, the response from students was enthusiastic. The problems encountered came as no

surprise to people in the field - lack of robustness of equipment (sometimes minor but crucial things such as mains plugs coming adrift, or television sets getting badly out of tune), and lack of integration of the teaching material in the curriculum.

In 1980 a further small trial was carried out at M101 summer school. That year two programmes were made to assist students with introductory computing: one covered use of the computer terminal and the other one dealt with introductory BASIC. Though the tapes were considerably better made and presented than the earlier ones, use of the system was hindered by inadequacy of the study environment and insufficient briefing of the tutorial staff. These are problems common to many new media.

It was decided in 1980 that a properly funded educational evaluation of Cyclops should take place when the new Cyclops became available in sufficient quantities. An opportunity arose when the Post Office Research Centre at Martlesham expressed interest in the electronic blackboard aspects of the system. A research contract was signed, and the trial is now under way in the East Midlands Region of the Open University. Fifteen study centres in that region

have had a Cyclops system and loud-speaking telephone installed and at the time of writing, plans are well advanced for tutoring some twenty courses in 1981 and 1982 by electronic blackboard means.

In an electronic blackboard tutorial, the tutor attends a study centre convenient to him. Some of his students may attend that centre, but most will attend other centres. Up to seven centres will be linked to the tutor's centre via a Post Office teleconference 'bridge' (logically speaking, two bridges, one for the loud-speaking telephones and one for the Cyclops data). Each participant can speak to the others and draw on his local screen at any point in time when nobody else is drawing on a screen.

We hope to discover the most appropriate protocols for participants to use when linked by such a system. The wider questions of educational effectiveness and user acceptance will also occupy much of the evaluation team's efforts.

The tutors in the East Midlands trial will also be encouraged to use pre-prepared tutorial Cyclops tapes as part of their electronic blackboard tutorials. These tapes will be made in a 'studio' which has been set up at the Open University campus in Milton Keynes. Space precludes a detailed description here of the studio; the following paragraphs will have to suffice.

The Cyclops Studio is a micro-computer system which allows a user to create colour or black and white pictures in computer-readable form. The guiding principle of the design has been that the Studio should be simple to understand and use, even by users with little if any knowledge of computing.

Pictures can be created by:

- placing artwork under a TV camera
- drawing on a digitising tablet
- typing at the keyboard of a VDU

Once a file of pictures has been created, they can be recorded onto a tape in synchronism with a previously recorded sound track. The result is a Cyclops tutorial tape.

Further details on the Cyclops studio and terminal will be found in [2].

4 Optel

For the first half of this paper I have concentrated on the terminal end of the delivery system. Now I will turn to the computer end.

The Open University was one of the Information Providers on Prestel during its market trial period, and consequently was in a good position to determine the potential educational benefits of such a system. In considering such benefits we took a wide view of education which included educational administration and information dissemination as well as teaching. Apart from criticisms of the display format (discussed earlier in this paper) our main worries were, on the information retrieval side, the difficulty in gaining rapid access to required information, and on the CAL side, the lack of any internal state variables which might be used to direct a CAL tutorial session. A subsidiary problem which became apparent later was that the "tariff structure was unsuited to educational institutions".

Consequently, we decided in late 1978 to develop an in-house viewdata system on our own time-sharing computers (DEC-20) free of the restrictions we had

identified. A further justification of implementing the system on our student service computers was that we hoped to take advantage of existing software (for example text editors). During 1979 the system was specified in successively greater detail, and serious implementation began towards the end of that year. A pilot trial of the system, by then called Optel, was run at the 1980 Open University summer school in Stirling, and I shall report on this in the next chapter.

But first, what is it that is different about Optel? Programmers may well be interested to know that it is implemented in COBOL on a DEC-20, an unusual combination for viewdata systems! But the language choice and machine are really fairly irrelevant - the implementation could equally well be Pascal on some other machine.

The fundamental difference between Optel and Prestel is that Optel has page <u>names</u> whereas Prestel has page <u>numbers</u>. Although indexes can be used (like telephone directories) to assign numbers to names, the benefits of using names when retrieving information are considerable, especially in applications where the vocabulary is standardised. A classic example in the

Open University is course codes: ours are of the form 'letters followed by three numbers', such as ST291 or D303. Other examples would be pharmaceutical names, town names, and names of computer programs.

However, in reality most items have subsidiary reference points, and we have also built these into Optel by providing a keyword system. Each page can have one or more keywords assigned to it and these keywords are automatically incorporated into inverted lists, so that when a keyword retrieval request is issued, the matching pages are read off the relevant list.

Obviously one could go further and incorporate standard bibliographic retrieval features such as compound retrieval requests, but here our design strictures about minimal CPU utilisation came into play, and thus we have not done so.

Arising from the general design of Optel, it became easy to relax certain other restrictions of Prestel. Pages can have an arbitrary number of frames, pages can have an arbitrary number of filials, and the database can be partitioned into sub-databases (user groups, with of

course, names not numbers).

In the early stages of the project, the Optel system did not have its own editor: information providers had to edit files using their favourite DEC-20 text editor and then load them into Optel. This was adequate so long as information providers were reasonably knowledgeable about computing, and carried out editing on scrolling VDUs rather than on Prestel terminals. After several attempts, it proved too difficult to adapt existing screen editors to Prestel terminals; in any case, standard text editors such as ECCE or TECO would not handle the colour and graphics facilities of Prestel terminals. Consequently, a straightforward but reasonably elegant frame editor has now been incorporated within the Optel program.

Evaluation of Optel

An early version of Optel has had a user trial in the OU. At the 1980 Summer School at Stirling, we set out to answer, among others, the following questions:

1 What kinds of work-related questions would students and staff like Optel to help them with?

2 What considerations can induce students and staff to use Optel?

3 What services should Optel provide in the longer term?

4 What is the appropriate methodology for a fuller evaluation of Optel?

The trial was based on three monochrome Prestel terminals placed in locations on the Stirling campus at which students congregate socially. There was some restriction on the times at which the terminals could be used in order to stay within an assigned telecommunications budget, but the limitation of access was not severe.

The information base consisted mainly of OU course choice information together with career information. Detailed course descriptions were provided for most courses; also an existing cross-reference of study areas, student interests and courses (the Interest/Course Index) was adapted to Optel and rounded out with additional tables such as Faculty information. This provided the richest network in the information base.

The career guidance information contained information sources for some 120 occupations classified in a standard way, augmented by specific OU degree recognition information.

Lastly, the information base contained University regulations, calendar, and exam timetables, together with a certain amount of local Stirling information.

The information base grew somewhat in size during the trial as obvious deficiencies were filled in, till at the end the base contained about 2200 data frames and about 1100 filial (routing) frames. Total disc storage came to about six million bytes.

The Summer School provided a suitable environment in which to make an initial evaluation of Optel. However, it is not the natural environment for Optel, which is mainly likely to be used in home, study centre and campus office contexts. In addition, most (but not all) of the information in Optel had already been published in relatively accessible form. Finally, some of the more sophisticated features, such as keyword retrieval, were tested hardly at all, because there was not enough time to construct useful keyword classifications. Nevertheless, the information bank was constructed in such a way that it would give a good impression of what a fully operational system would look like.

The installation of terminals and software was on time, publicity and documentation were adequate, and there was no need to sell the idea to students: the terminals were well used from the beginning.

The initial method of evaluation consisted mainly of observing user reactions. There were informal discussions with people both before and after use, and also some sessions during which views on specific aspects of the system were solicited. The main aim was to produce a qualitative assessment.

During one week (the fourth) a more formal evaluation was carried out. Based on the qualitative information gained thus far, a questionnaire was designed. Users were requested to complete this, in part during their use of Optel and then add further comments after the session.

A certain amount of quantitative data was gathered automatically. The Optel system itself kept records of the number of accesses for each page, and the DEC-20 computer accounting system also recorded running totals of access time.

After the summer school was over, the evaluation team organized their conclusions into a report [3]. This gave the following answers to the questions posed at the beginning of this section.

1 Staff and students did not appear to come to Optel with preconceived information needs. However, after using Optel, many ideas on information needs were produced. Course-related information was desired because many students felt they did not know enough about courses to judge their relevance to their interests and career plans. Other course-related ideas

included lists of additional reading found useful by fellow students (or tutors), and a faster way of getting stop-press material (such as errata) to students.

2 The main short-term inducement to use Optel seemed to be its technological novelty, and the bandwagon effect. But longer-term inducements seemed to depend on quality, effectiveness, and ease of use of information on Optel.

3 Longer-term services which users wished for fell mainly in the areas of message-passing (student-student or student-teacher) and computer assisted/managed learning activities shading off into general use as a time-sharing computer terminal.

4 Three conclusions were reached about the appropriate methodology for future evaluations:

- the trial has to be large scale in both size of information bank and number of terminals

- clear distinctions have to be made between retrieval users and information providers, staff and students, and casual and experienced users of any category

- considerably different evaluation strategies are needed to discover perceived deficiences as opposed to perceived potentialities.

Of course, in addition to the more educational aspects of the trial, a great deal of information was gained about the reliability (or otherwise) of terminals and phone lines.

Regarding the aspects of running a viewdata-type service in an educational institution, the trial gave added weight to the judgement that such systems place a heavy load on the information providers in order to lighten the load on retrieval users.

6 Current work

The Cyclops terminal and studio are nearing the end of the current phase in their development. The near future will be largely devoted to evaluation and use of the system.

Optel is very much more a system in transition. However, the major and minor deficiencies identified at the summer school trial have mainly been remedied - in particular the lack of an integral Prestel-format screen editor. Current work is now turning to reconstruction of the user interface along Prestel lines to support both alphanumeric and numeric-only terminals, and reform of the internal storage mechanism to allow easier storage of Cyclops - format frames. This latter reform will allow storage of arbitrary ASCII characters in frames - a fact which may also make for economical storage of object code programs for Cyclops or other microprocessors.

Storage of telesoftware in source form is of course already possible, and the use of page names and keyword retrieval make it easy to classify software and its associated documentation. We do not have a telesoftware terminal to latch on to the specific Optel interface, but if the need were to arise

the modifications to existing terminal interfaces would not be large.

The fusion of Optel with mainstream CAL can take place from either of two directions. From below, one could add limited scoring facilities to Optel pages (bearing in mind the strictures about CPU utilization) so as to provide a simple multiple-choice type of CAL on Prestel terminals. Alternatively, one can proceed from above, and in fact this is what is happening first. As reported on elsewhere, the OU has already started work on linking graphics terminals to STAF, and (with others) considering how to link visual display units with author language systems. It is my feeling that this will come to useful fruition faster than the first approach. One point I would wish to stress is that Prestel terminals are not just VDUs, and that any author language for VDUs must take account of the colour and other attributes available (and useful) on Prestel terminals.

7 Acknowledgements

The total number of people who have worked in some significant way on the Optel and Cyclops projects and their evaluations is now quite large, enough so that in a survey paper of this sort it would be invidious to single out individuals for mention. Some names figure in the references, but one should remember that some who work hardest publish the least.

The development of the Cyclops terminal and studio has been significantly supported by Aregon International Ltd., an NEB company, who own the marketing rights to the Cyclops system. British Telecom (formerly the Post Office) are also largely supporting the current evaluation of Cyclops in the East Midlands.

References

1 Bacsich P.D., Frogbrook P., Mathur G.,
Specification of the Pilot OPTEL System,
Optel Report No.4, Open University (1980).

2 Francis A.,
Cyclops - Graphics for Videotex,
to appear in proceedings of SIGGRAPH '81

3 Frogbrook P., Zimmer R., Zorkoczy P.,
Report on the Evaluation of the Optel Pilot System,
Optel Report No.6, Open University (1980).

4 Read G.A.,
An application of micro-electronics to education at a distance,
Educational Broadcasting International, 1977.